

Appl. No. 10/783,495  
Amdt. Dated 12/09/2009  
Resp. to 09/15/2009 OffI action

Attorney Docket No.: N1085-00251  
[TSMC2003-0834]

**Claims:**

The listing of pending claims is as follows:

- 1 1. (Previously Presented) A method for controlling exposure energy on a patterned wafer substrate, comprising the steps of:
  - 3 controlling the exposure energy with a feedback process control signal of critical dimension,
  - 5 and further controlling the exposure energy with a feed forward process control signal of a compensation amount that compensates for thickness variations in a subjacent layer beneath a top layer, by combining the feed forward process control signal with the feedback process control signal to control the exposure energy used in patterning the top layer,
  - 10 the critical dimension being one of a width, a spacing and an opening of the patterned wafer substrate and the top layer being a non-photoresist layer.
- 1 2. (Cancelled)
- 1 3. (Original) The method of claim 1, further comprising the step of: supplying the feed forward process control signal by a feed forward controller.
- 1 4. (Previously Presented) The method of claim 1, wherein the subjacent layer comprises an interlayer.
- 1 5. (Previously Presented) The method of claim 4, wherein the step of controlling the exposure energy by a feed forward process control signal utilizes a signal of measurement of thickness remaining of the interlayer after chemical mechanical planarization thereof.
- 1 6. (Original) The method of claim 1, further comprising the step of: calculating the compensation amount according to a polynomial function with a coefficient of the

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3 function being based on a measurement of a remaining thickness of a planarized  
4 interlayer.

1 7. (Previously Presented) The method of claim 1, further comprising the step of:  
2 calculating the feedback process control signal of critical dimension measurement of a  
3 top layer in a previous manufacturing lot.

1 8. (Previously Presented) The method of claim 1, further comprising the steps of:  
2 calculating the compensation amount according to a polynomial function with a  
3 coefficient of the function being based on a measurement of a remaining thickness of  
4 the subjacent layer; and calculating the feedback process control signal of critical  
5 dimension measurement of a top layer in a previous manufacturing lot, the subjacent  
6 layer being a planarized interlayer.

1 9. (Previously Presented) The method of claim 1, further comprising the step of:  
2 calculating the compensation amount according to a polynomial function with higher  
3 order coefficients set at zero.

1 10. (Previously Presented) The method of claim 1, further comprising the step of:  
2 calculating the compensation amount according to a linear function.

1 11. (Previously Presented) The method of claim 1, further comprising the step of:  
2 calculating the compensation amount according to a segmented linear function.

1 12. (Previously Presented) A system for controlling exposure energy on a first  
2 patterned wafer substrate, comprising:  
3 a feed forward controller providing a feed forward control signal to an exposure  
4 apparatus based on a thickness measurement of an interlayer of the first patterned  
5 wafer substrate for controlling the exposure energy focused on a top layer of the first  
6 patterned wafer substrate, and

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7        a feedback controller providing a feedback exposure energy control signal to the  
8 exposure apparatus based on critical dimension measurement of a top layer of a  
9 second patterned wafer substrate of a previous manufacturing lot, the critical dimension  
10 being one of a width, a spacing and an opening of the second patterned wafer  
11 substrate,

12        wherein a combiner combines the feed forward control signal and the feedback  
13 exposure energy control signal to produce a combined signal that is provided to the  
14 exposure apparatus, the top layer being a non-photoresist layer.

1        13. (Original) The system of claim 12, further comprising: a thickness measurement  
2 device providing thickness measurement data to the feed forward controller.

1        14. (Previously Presented) The system of claim 12, further comprising: a critical  
2 dimension measurement device providing critical dimension measurement data to the  
3 feedback controller.

1        15. (Previously Presented) The system of claim 12, further comprising:  
2            a thickness measurement device providing thickness measurement data to the  
3 feed forward controller and  
4            a critical dimension measurement device providing critical dimension  
5 measurement data to the feedback controller.

1        16. (Previously Presented) The system of claim 12, further comprising: a thickness  
2 measurement device providing thickness measurement data of a shallow trench  
3 isolation layer of the first patterned wafer substrate to the feed forward controller.

1        17. (Previously Presented) The system of claim 12, further comprising: a critical  
2 dimension measurement device providing critical dimension measurement data of a  
3 poly-gate of wafer substrate of a previous manufacturing lot.

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- 1 18. (Previously Presented) The system of claim 12, further comprising:
  - 2 a thickness measurement device providing thickness measurement data of a
  - 3 shallow trench isolation layer of the first patterned wafer substrate to the feed forward
  - 4 controller, and
  - 5 a critical dimension measurement device providing critical dimension
  - 6 measurement data of a poly-gate of a previous manufacturing lot.
- 1 19. (Previously Presented) The system of claim 18 wherein,
  - 2 the feed forward controller is user configurable by having one or more polynomial
  - 3 coefficients set to zero in a polynomial function model.
- 1 20. (Original) The system of claim 12 wherein;
  - 2 the feed forward controller is user configurable by having one or more polynomial
  - 3 coefficients set to zero in a polynomial function model.
- 1 21. (Previously Presented) The system of claim 20, further comprising: a thickness measurement device providing thickness measurement data of a shallow trench isolation layer of the first patterned wafer substrate to the feed forward controller.
- 1 22. (Previously Presented) The system of claim 20, further comprising: a critical dimension measurement device providing critical dimension measurement data of a poly-gate of the second patterned wafer substrates of a previous manufacturing lot.